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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/317,536      | 05/24/1999  | BIN ZHAO             | 97RSS256-DIV        | 9245             |

7590 04/25/2002

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EXAMINER

OWENS, DOUGLAS W

ART UNIT PAPER NUMBER

2811

DATE MAILED: 04/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/317,536

Applicant(s)

ZHAO ET AL.

Examiner

Douglas W Owens

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 16-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28-33 is/are allowed.
- 6) ☒ Claim(s) 16-27 and 34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 28, 2002 has been entered.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

3. Claims 16-20, 23, 24, 26 and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by US patent No. 6,222,269 to Usami.

Regarding claims 16 and 34, Usami teaches an interconnect comprising:

metal lines (3) with gaps therebetween;  
low-k material (5) filling the gaps;  
a protective layer (6, 7) over the metal lines and low-k material;  
a dielectric layer (8) over the protective layer, wherein the dielectric layer has a different composition than the low-k material;  
a via in the dielectric layer;  
a metal (9) filling the via;  
a second metal (10, Col. 7, lines 5-8 and 62-65) layer over the dielectric layer;  
and  
an opening in the protective layer for allowing the metal in the via to contact the metal lines.

Regarding claims 17 and 18, Usami teaches an interconnect, wherein the protective layer includes silicon dioxide.

Regarding claim 19, Usami teaches an interconnect, wherein the protective layer includes a dielectric material.

Regarding claims 20 and 23, Usami teaches an interconnect, wherein the protective layer includes silicon nitride.

Regarding claim 24, Usami teaches an interconnect, wherein the first metal layer is an aluminum alloy (Col. 7, lines 2-10), the metal filling the via is tungsten (Col. 7, lines 54-60), and the second metal layer is an aluminum alloy (Col. 7, lines 62-65).

Regarding claim 26, Usami teaches an interconnect, wherein the dielectric layer is silicon dioxide, the protective layer is silicon nitride, and the low-k material is an organic low-k material.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 21, 22, 25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usami.

Regarding claim 21, Usami does not teach an interconnect, wherein the protective layer is silicon carbide. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use silicon carbide, since it is a known material that is well suited for the intended use.

Regarding claim 22, Usami does not teach an interconnect comprising a spacer on the vertical portion of the low-k material. It is conventional in the art to provide spacers in vias where metal fills are performed for various reasons. It would have been obvious to one of ordinary skill in the art to include a spacer since it is desirable to protect the dielectric material, as well as preventing unwanted diffusion of metal impurities.

Regarding claim 25, Usami teaches an interconnect, wherein the first and second metal layer is aluminum alloy. Usami does not teach an interconnect, wherein the metal

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filling the via is an aluminum alloy. It would have been obvious to one of ordinary skill in the art to select an aluminum alloy since it is a known material that is well suited for the intended use.

Regarding claim 27, Usami teaches an interconnect, wherein the dielectric layer is silicon dioxide and the protective layer is silicon nitride. Usami does not teach an interconnect, wherein the low-k material is porous silicon dioxide. It would have been obvious to one of ordinary skill to use porous silicon dioxide since it is a known material that is well suited for the intended use.

#### ***Allowable Subject Matter***

6. Claims 28-33 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record does not teach an interconnect, wherein portions of the dielectric material are disposed between portions of the low-k material.

#### ***Response to Arguments***

7. Applicant's arguments with respect to claims 16-27 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for

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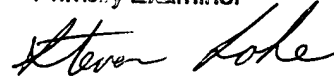
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the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

DWO  
April 20, 2002

Steven Loke  
Primary Examiner

A handwritten signature in black ink, appearing to read "Steven Loke", written in a cursive style.